

**A New Method For The Diagnosis Of Ocean
General Circulation Models**

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Abstract

We have developed a new technique for diagnosing the tracer transport properties of ocean general circulation models. This method involves the computation of the (often spurious) source and sink fields that would be required to maintain the observed tracer fields, given the ocean circulation model's tracer transport properties. In general, these source/sink fields should be zero in the interior of the ocean. If the fields are significantly non-zero then there are problems either with the modeled circulation, the "observed" tracer fields, or both. We use more than one observed tracer field (temperature and salinity) to try to minimize the impact of bad "observed" data. The regions in which large spurious sources or sinks are required to maintain observed fields are probably regions with inappropriately modeled tracer transport process (i.e. improper advection, diffusion, or convection).

We demonstrate this technique by comparing two simulations with an enhanced version of the GFDL ocean general circulation model, one with and one without the Gent-McWilliams parameterization for the effects of subgrid scale eddies on ocean tracer transport. In the first simulation, the parameterization of horizontal tracer transport by subgrid scale eddies transports low density tropical intermediate water to high latitudes, which produces spurious density instabilities which are removed through convective adjustment. We find that the Gent-McWilliams parameterization improves model performance, largely by eliminating this spurious density transport and consequent convection.

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